## TENSION MEMBER EXAMPLE (CONT'D FROM BLOCK SHEAR EXAMPLE)

BOLT HOLE BEARING:

$$\phi R_n = \phi 1.2 l_c t F_u \leq 2.4 d t F_u$$

$l_c$ = CLEAR DISTANCE

$$0.75 \times 1.2 \left(3 - \frac{(3/8 + 1/8)}{2}\right)(0.5)(65)(4)$$

$F_u$

(4) BOLTS

LOWEST VALUE (CONSERVATIVE)

$$\phi R_n = 391^k \text{ TOTAL}$$

BOLTS SHEAR:

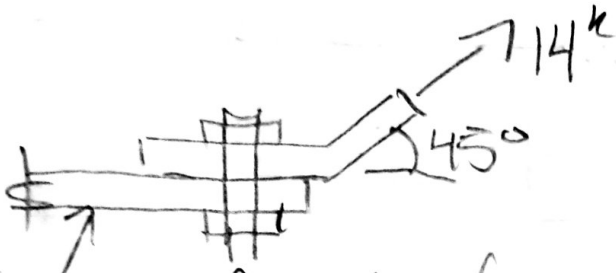
$$\phi P_n = \phi F_n A_b N_{BOLT}$$

$$= 0.75 (54 ksi)(0.11 in^2)(4) = \underline{\underline{17.8^k}}$$

54 ksi: TABLE J3.2 A325 SHEAR

CAPACITY LIMITED BY BOLTS.

# COMBINED TENSION / SHEAR:




1/2" PL — ↑ 5/8" ϕ BOLT A325-N

ASSUME PL DOES NOT GOVERN

SOLUTION:

$V_u = 14^k \times \cos 45^\circ = 10^k$

$T_u = 14^k \times \sin 45^\circ = 10^k$

NEED TO SOLVE w/ $F_{nt}'$

$$F_{nt}' = 1.3F_{nt} - \left(F_{nt}/\phi F_{nv}\right) f_{rv} \leq F_{nt}$$

$F_{nt} = 90$ ksi

$F_{nv} = 54$ ksi

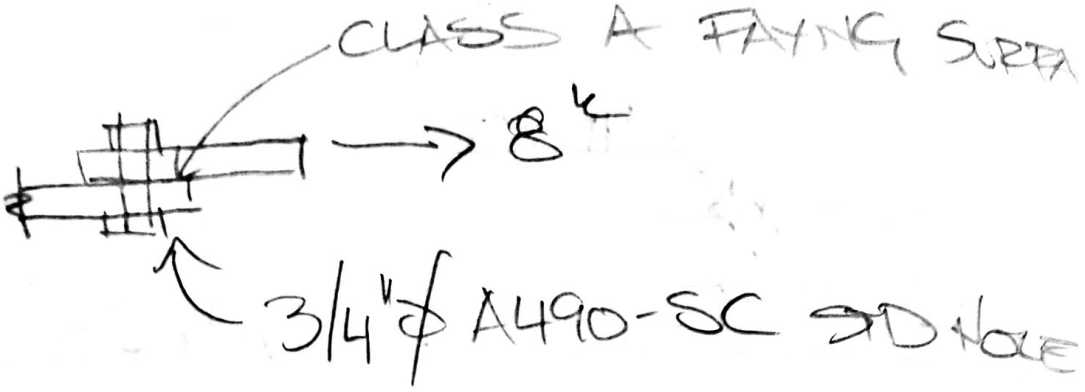
$f_{rv} = 10^k / (0.307 in^2) = 32.6$ ksi

$F_{nt}' = 1.3 \times 90 - (90/0.75 \times 54) \times 32.6 = 45$ ksi

$\phi R_n = 0.75 F_{nt}' \times A_{BOLT} = 0.75 \times 45 \times 0.307 in^2$

$\phi R_n = 10.4^k > 10^k = T_u$ ok ✓

# SLIP CRITICAL → SHEAR ONLY




ASSUME IT DOES NOT GOVERN

SOLUTION:

$$\phi R_n = 1.0 \times \mu D_u h_f T_b n_s$$

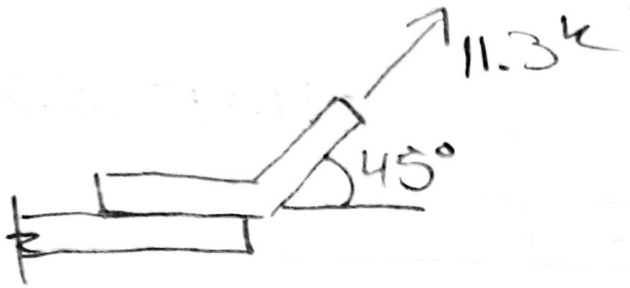
(1.0 ← STD HOLE)

$\mu = 0.3$ (CLASS A)
$D_u = 1.13$ (AVG BOLT PRETENSION FA
$h_f = 1.0$ (NO FILLERS)
$T_b = 35^k$ (TABLE J3.1)
$n_s = 1.0$ (1 SLIP PLANE)

$$\phi R_n = 1.0 \times 0.3 \times 1.13 \times 1.0 \times 35^k \times 1.0$$
$$= 11.8^k$$

$$R_u = 8^k \leq \phi R_n = 11.8^k \quad \text{ok} \checkmark$$

# COMBINED TENSION/SHEAR OF SLIP CRITICAL BOLT




SAME INFO AS PREVIOUS PROBLEM.

$V_u = 8^k$

$T_u = 8^k$

MULTIPLY SLIP ~~RESISTANCE~~ BY $K_{sc}$

$$K_{sc} = 1 - \left( T_u / D_u T_b n_b \right)$$

$$= 1 - 8 / 1.13 \times 35 \times 1.0 = 0.8$$

$$\phi R_n = 11.8^k \times 0.8 = 9.44^k$$

↑ FROM PREVIOUS

$R_u = 8^k$ (SHEAR) $< \phi R_n = 9.44$ ok ✓